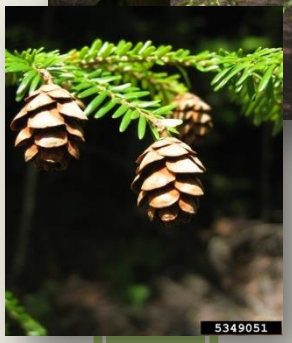
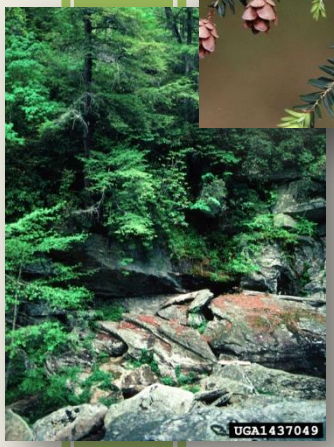




Eastern hemlock

Tsuga canadensis

Hemlock is a very slow-growing, shade tolerant species which was much more prevalent before the Cutover at the turn of the century. However, **hemlock volume is recovering** with an increase of 60% since 1983.

In the last two decades, g**rowth rates have increased** and mortality has remained unchanged, though much lower than other species. Hemlock accounts for about 2% of all volume and 1.4% growth of trees in Wisconsin, but 0.7% of total mortality.

Hemlock is not an important timber species, accounting for less than 1% of all roundwood. The low volume of hemlock and relative low wood density, may

- *How has the hemlock resource changed?*
  Growing stock volume and diameter class distribution: 1983, 1996, and 2012
- *Where does hemlock grow in Wisconsin?*
  Growing stock volume by region with map
- *How fast is hemlock growing?*
  Average annual net growth by region and year: 1983, 1996, and 2012
- *How healthy is hemlock in Wisconsin?*
  Average annual mortality: 1983, 1996, and 2012
- *How much hemlock do we harvest?*
  Roundwood production by product: 1997, 2003, and 2009
- *How much is hemlock selling for?*
  Prices for cordwood and sawtimber: 2000 to present
- *How much hemlock biomass do we have?*
  Aboveground carbon by region of the state: 2012

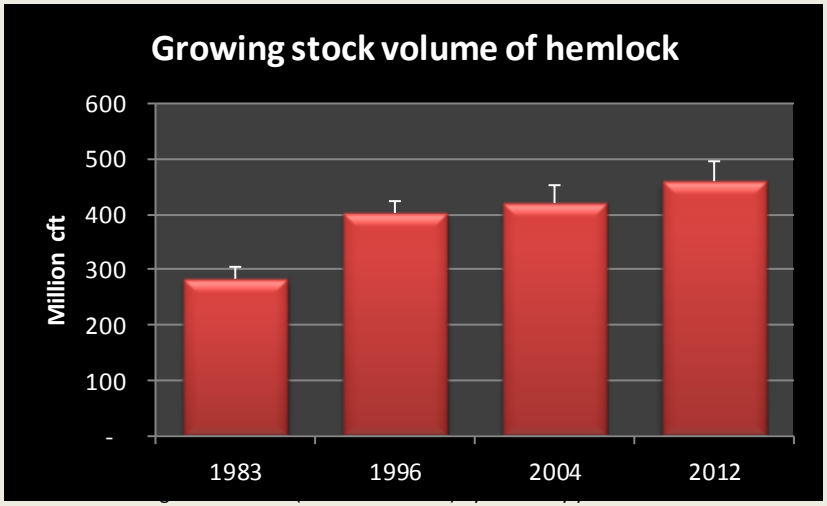
"How has the hemlock resource changed?"

Growing stock volume and diameter class distribution by year

The growing stock volume of hemlock in Wisconsin was about 459 million cft or 2.1% of total volume in 2012 (Chart 1). This is an increase of 62% since 1983. Volume has remained statistically unchanged since 1996.

The hemlock resource has matured since 1996 with more volume in the largest size classes (Chart 2). For instance, the volume in small trees (5 to 13 inches) has increased 23% since 1983 and the volume in large trees (over 13 inches) has increased 83%. Half of hemlock volume is in trees over 17 inches in diameter.

The number of sapling and sawtimber trees has increased while the number of seedlings and pole has decreased (Chart 3).



Source: USDA Forest Inventory and Analysis data: 1983, 1996, and 2012.

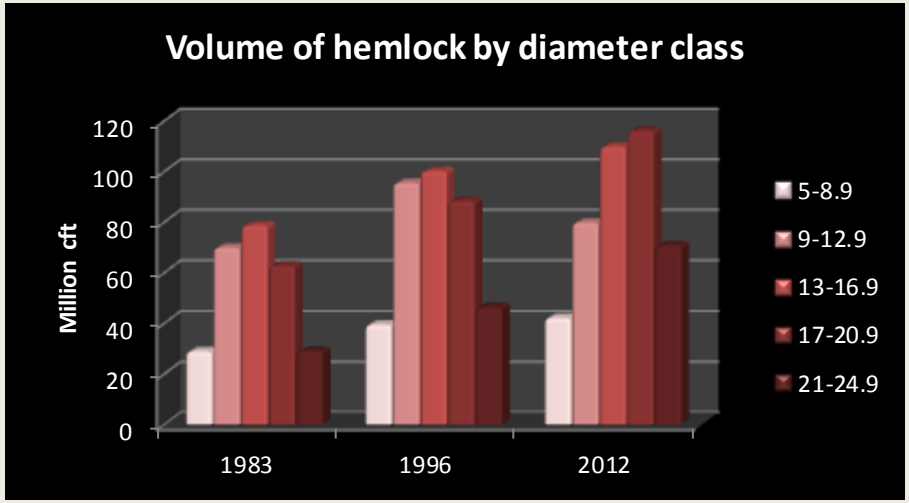


Chart 2. Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, and 2012.

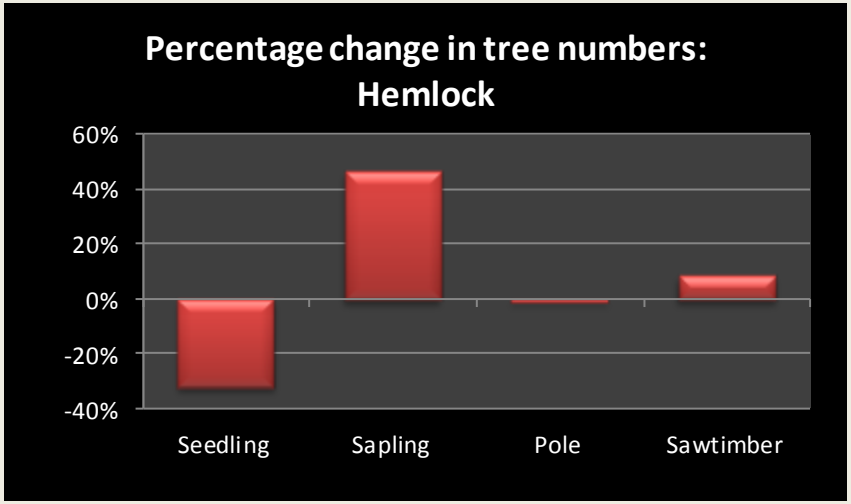
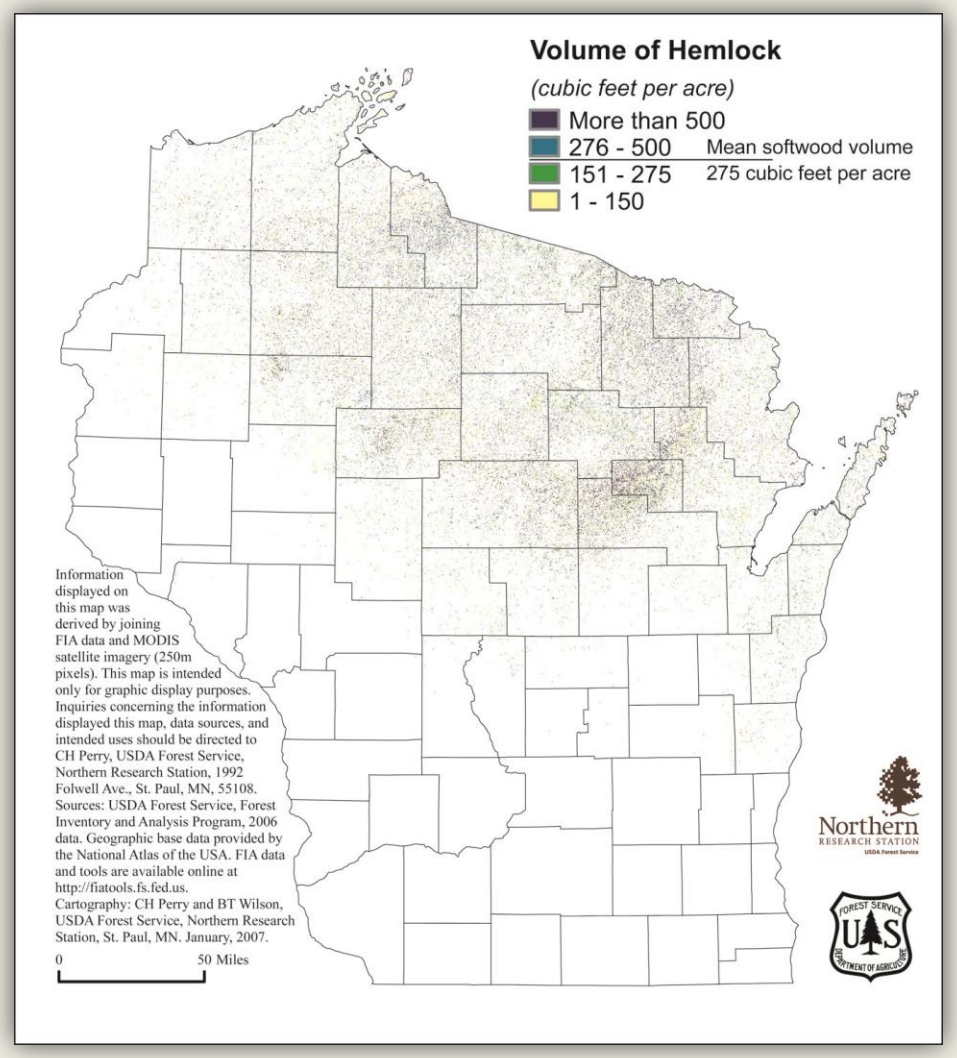


Chart 3. Percentage change in the number of live trees by size class between 1996 and 2012.
Source: USDA Forest Inventory and Analysis data 1996, and 2012.

"Where does hemlock grow in Wisconsin?"

Growing stock volume by region with map



About 87% of hemlock volume is located in northern Wisconsin, mainly in the northeast region (Table 1). It is found mainly in the maple-basswood forest type and to a lesser extent, on the white and red pine type.

Table 1. Growing stock volume (million cft) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total
Eastern hemlock	35	268	134	22	-	**459**
Percent of total	**8%**	**58%**	**29%**	**5%**	**0%**	**100%**

Source: USDA Forest Service, Forest Inventory and Analysis 2012 data

For a table on **Volume by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf

"How fast is hemlock growing?"

Average annual net growth by region and year

Average annual net growth of hemlock has more than doubled since 1983 to about 8.0 million cft/year for the period 2008 to 2012 (Chart 4). This represents about 1.4% of total volume growth in the state. Growth rates have almost tripled since 1983.

Although northern Wisconsin has the highest percentage of volume growth in hemlock, 78%, the ratio of growth to volume is highest in the central part of the state (Table 2).

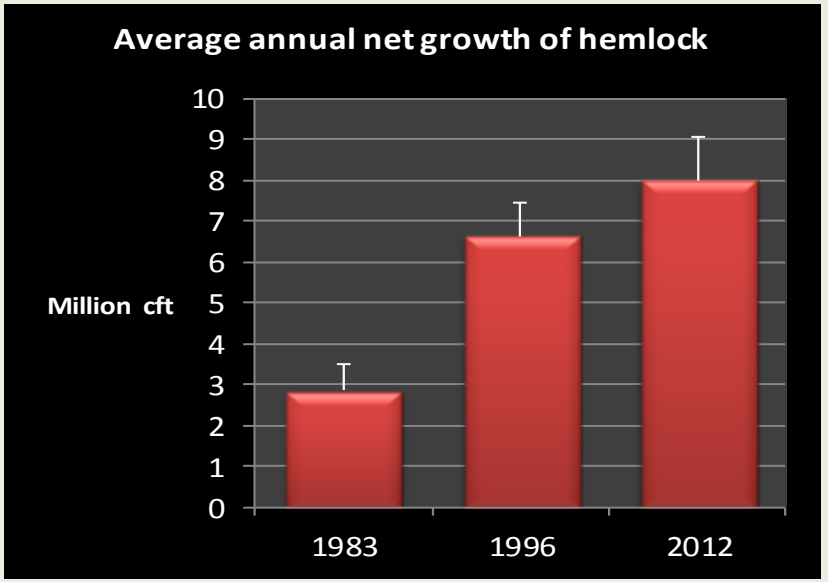


Chart 4. Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2012

Table 2. Average annual net growth (million cft/year) of growing stock and the ratio of growth to volume by region of the state.

Region	Net growth	Percent of Total	Ratio of growth to volume
Central	1.5	18%	**4.2%**
Northeast	4.8	60%	**1.8%**
Northwest	1.4	18%	**1.1%**
Southeast	0.3	4%	**1.4%**
Southwest			
Statewide	**8.0**	**100%**	**1.7%**

Source: USDA Forest Inventory & Analysis data: 2012

The average statewide ratio for hemlock is 1.7%, much lower than the statewide average of 2.6% for all species. Hemlock is a very shade tolerant, slow-growing species.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How healthy is hemlock in Wisconsin?"

Average annual mortality: 1983, 1996, and 2012

Average annual mortality of hemlock, about 1.3 million cft per year, has remained statistically unchanged for the last three decades. These numbers are approximations since they have a high sampling error.

The ratio of mortality to gross growth is 14.5% for hemlock, **lower than the statewide average** of 29.3% (Table 3). Whereas hemlock accounts for 2.1% of total growing stock volume in the state, it makes up less than 1% of total mortality.

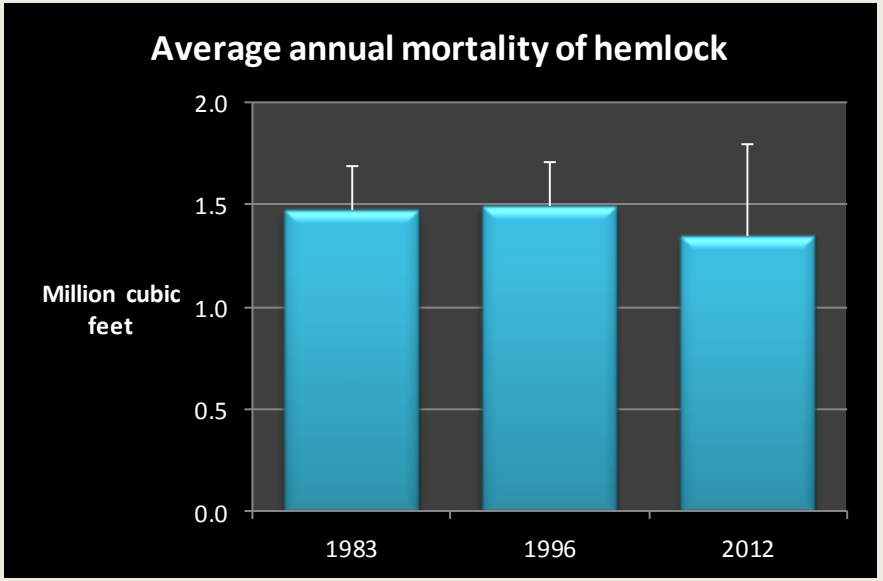


Chart 5. Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2012

Table 3. Mortality, gross growth and the ratio of mortality to gross growth.

Species	Average annual mortality (cft)	Average annual gross growth (cft)	Mortality / growth
Eastern Hemlock	**1,349,814**	**9,326,635**	**14.5%**

Source: USDA Forest Inventory & Analysis data: 2012

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much hemlock do we harvest?"

Roundwood production by product and year

In 2003, hemlock produced 1.3 million cft or less than 1% of Wisconsin's total roundwood production (Chart 6). Of this, 80% was used for pulpwood and 20% for sawlogs.

Between 2003 and 2009, hemlock pulpwood production had decreased by 62%.

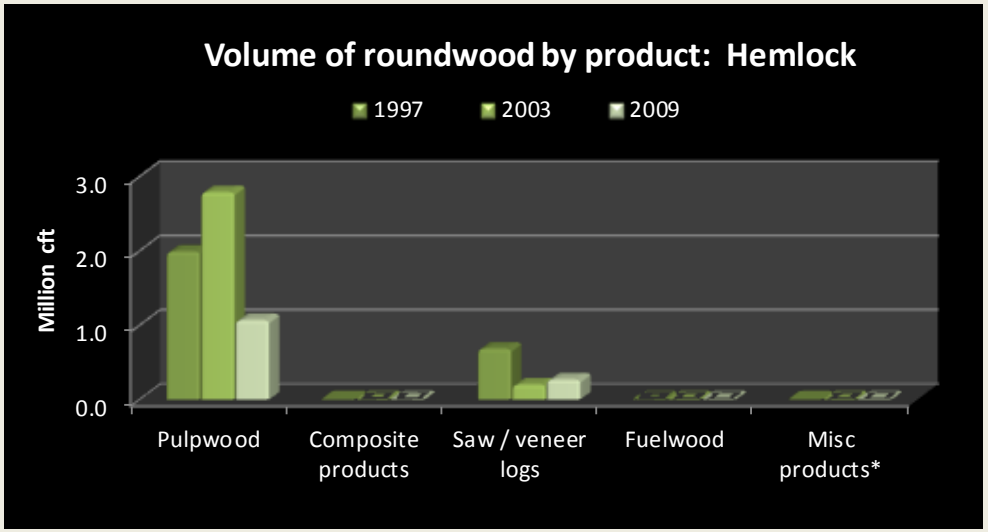


Chart 6. Volume of roundwood products. * Miscellaneous products include poles, posts, and pilings.
Source: Ronald Piva, USDA Forest Service, Northern Research Station, St. Paul MN

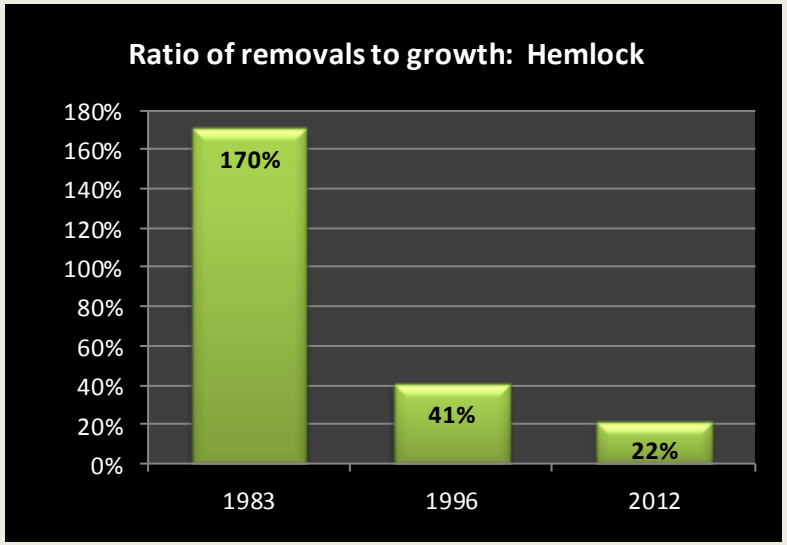


Chart 7. Ratio of volume harvested annually to net growth.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012.

The ratio of removals to growth has decreased significantly since 1983 and now stands at 22%, much lower than the average of 53% for all species in the state (Chart 7). This is not due so much to decreased harvest as it is to increases in growth rates. Net growth rates for hemlock have more than tripled since 1983.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much is hemlock selling for?"

Prices for cordwood and sawtimber: 2000 to present

Since timber prices vary considerably from region to region, the prices reported here are weighted average stumpage prices from Wisconsin Administrative Code Chapter NR46 (chart 8).

Stumpage prices for both logs and cordwood peaked in 2006-2008 and have fallen considerably since (Table 4). They are both currently far below average for softwood prices in the state.

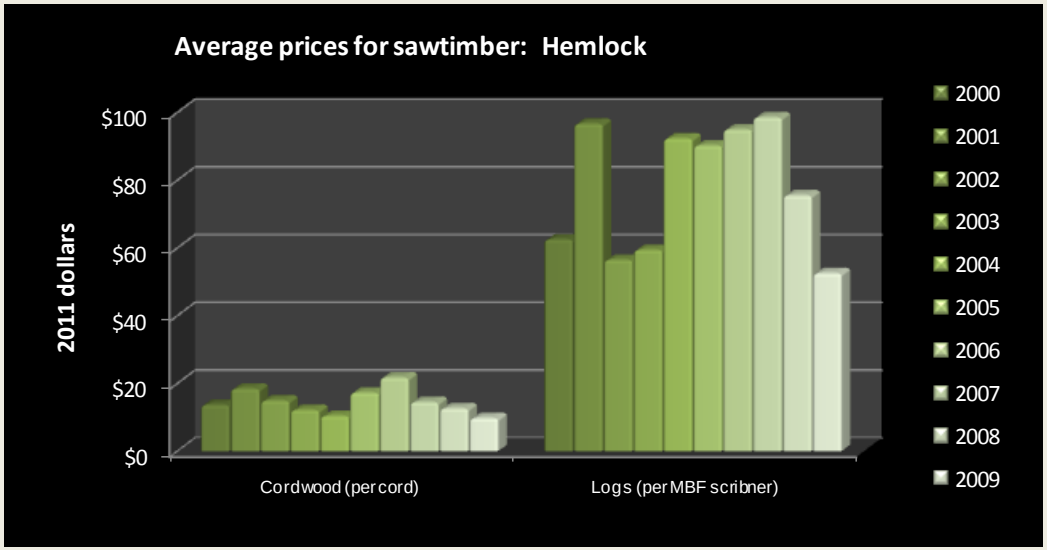


Chart 8. Average prices for cordwood and sawtimber (2008).
Source: Wisconsin Administrative Code Chapter NR46, 2000 to 2012

Table 4. Average weighted stumpage prices (adjusted for inflation to 2012 dollars) by year for Wisconsin.

Product	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	Average for all softwoods
Cordwood (per cord)	$16	$13	$11	$19	$15	$11	$13	$10	$10	**$16**	$30
Logs (per MBF)	$61	$64	$99	$97	$264	$77	$79	$56	$55	**$93**	$103

Source: Wisconsin Administrative Code Chapter NR46, 2002 to 2012. The stumpage values calculated each year are for the sole purpose of assessing MFL yield and FCL severance taxes, not for determining the price that should be received for timber.

"How much hemlock biomass do we have?"

Aboveground carbon by region of the state

There were 9.7 million tons of aboveground biomass in live hemlock trees in 2012, an increase of 76% since 1983. This is equivalent to approximately 4.8 million tons of carbon and represents 1.6% of all biomass statewide. As with volume, most hemlock is located in northeast Wisconsin (Chart 9).

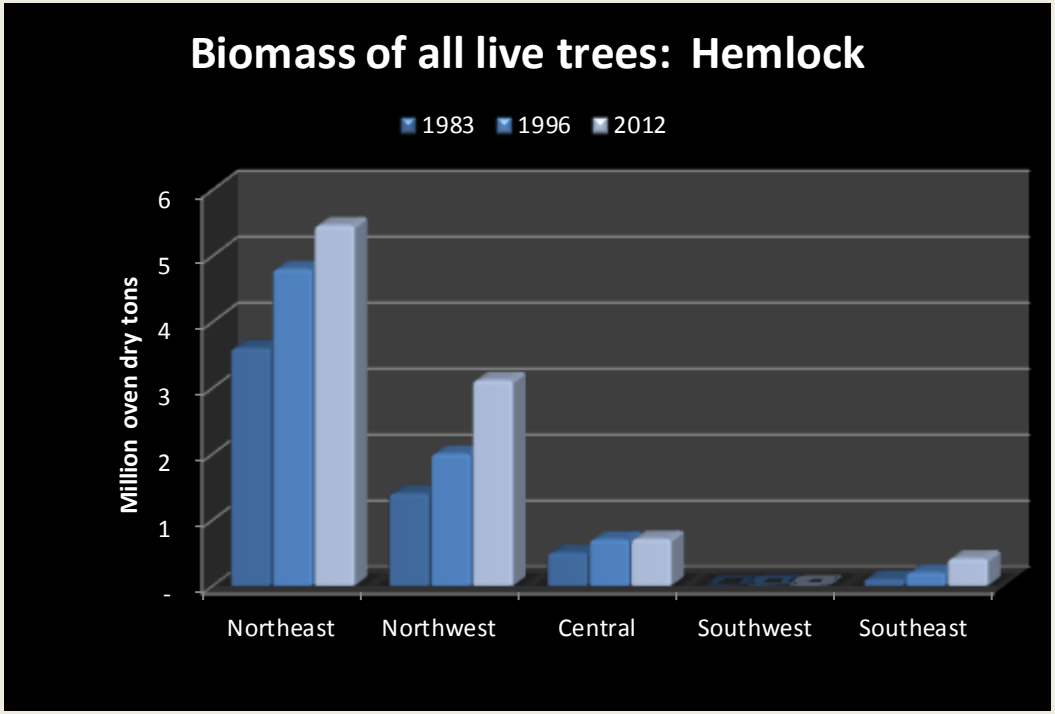


Chart 9. Biomass (million oven-dry tons) by year and region.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012

Hemlock has a fairly low wood density but higher than other softwood species, with a ratio of biomass to volume of 37 oven-dry lbs. per cubic foot (ODT/cft). The average for all softwoods is about 34.3 ODP/cft and for all species is 46.8 ODP/cft.

A very high proportion, 82%, of all hemlock biomass is located in the main stem with only 14% in branches.

For a table of **Biomass by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf